

1. Which can be used as 1st stand in Redox.

- a - K_2CrO_7 b - $K_2Cr_2O_7$ c - oxalic acid d - $KMnO_4$
e - a, b f - b, c

2. Which can be used as redox indicator.

- a - EBT b - Fe^{+3} c - DAPI d - all

3. $KMnO_4$ in acid med. gain _____ electrons to Mn^{2+}

- a - 2 b - 4 c - 5 d - none

4. Which is specific indicator for Fe^{+3} :-

- a - EBT b - $KSCN$ c - KIO d - KI

5. Which is self indicator -

- a - K_2CrO_7 b - $KMnO_4$ c - Br_2 d - PAN

6. Methylene blue is _____ ind.

- a - redox b - pH c - acid-base d - none
Sally bridge plw

7. Constant for each G.E.

- a - asymmetry potential b - boundary Pot c - Junction potential

8. has pH range 0-14:-

- a - G.E b - anthraquinone c - Quinhydrone

17. to detect glass sensitive to Na^+ ^{from the basic}
 a - H_2SiO_3 ~~H_2SiO_3~~ c - Correct
 ~~H_2SiO_3~~

18. to detect gas ^{Na^+}
 a - Clark electrode b - gas sensing probe ^{Calomel electrode}

19. 2nd ref. E -
 a - 0.1M CE ^{in decar} b - CE c - SHE

20. to ion exchanger to detect K^+
 a - dodecyl phosphate b - exchange resin ^{- valinomycin}

21. hygroscopicity -
 a - affect I_3/I^- system b - affect couplet reaction
 c - affect G.E

22. to detect glucose using I_3/I^- system use -
 a - borax b - NaHCO_3 c - NaOH

23. to detect Arsenite iodometrically we add
 a - HCl b - NaHCO_3 c - NaOH

24. to detect Ferrous iodometrically we use add
 a - PbO_2 b - FeO_2 c - Zn^{+2}

① To titrate Ca^{2+} by EDTA is indicated by

a- $\text{NH}_3 / \text{NH}_4\text{Cl}$ b- H_2O c- $\text{CH}_3\text{COOH} / \text{CH}_3\text{COONa}$

d- either one e- neither one

② which can be titrated by EDTA at pH 1-3

a- Bi^{3+} b- Hg^{2+} c- Fe^{3+} d- either e- neither

③ used as pH Indicator -

a- DPA b- ~~EBT~~ EBT c- KSCN

④ which can be titrated by EDTA

a- Ag^+ b- Ni^{2+} c- Cu^{2+}

⑤ Masking agent for interference ion -

a- BAL b- TEA c- KI

⑥ liberate Zn^{2+} from its Glycine complex

a- glucose b- NaOH / HCl c- HCHO

⑦ specific indicator for Fe^{3+} -

a- EBT b- ~~KSCN~~ KSCN c- NaOH d- HR

⑧ Quinhydrone ligand

9. Methylene blue is one of the indicators.

~~a~~ Redox b. DM c. Non-alkaline a-base

10. used to det. ald. -

a. KI_3 b. KIO_3 ~~c. I_2/OH^-~~ (hydroxide)

11. Component of ZAR a. $ZnSO_4$ ~~b. $MnSO_4$~~ c. HCl

12. $KMnO_4$ is a Medium gain ----- electrons to Mn^{2+}

a. 2 ~~b. 5~~ c. 4 d. none

13. used as 10.5 standard oxidant

a. $KMnO_4$ ~~b. $K_2Cr_2O_7$~~ c. Gold (oxidant) d. $Na_2S_2O_3$

14. back titrant for periodate ^{I_2}

a. $Na_2S_2O_3$ b. KI_3 ~~c. Na_3AsO_3~~

15. lower oxid potential of Fe^{3+}/Fe^{2+} system

a. $ZnSO_4$ ^F ~~b. $H_2PO_4^-$~~ c. HCl

16. Component of KF reagent

~~a. SO_2~~ b. $MnSO_4$ c. KI/KH_2

(18) $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$
a - SHE b - Zn^{2+}/Zn c - H^+/H_2 d - $\text{O}_2/\text{H}_2\text{O}$

(19) electrode of the first type

a - Ag^+/AgBr b - Zn^{2+}/Zn c - H^+/H_2

(20) Single Crystal ISE -

a - GE b - LME c - F-ISE

(21) type of 2nd type whose potential is pH dependant

a - GE b - Quinhydrone E c - antimony E

(22) electrode whose potential depend on Br^- ions -

a - $\text{Zn}^{2+}/\text{ZnBr}_2$ (soln) b - Ag^+/AgBr (solid) c - CE

(23) ^{redox} Iodometry can detect -

a - Fe^{2+} (soln) b - H_2O_2 (soln) c - $\text{K}_2\text{Cr}_2\text{O}_7$ (solid)

(24) hyph iodite is -

a - strong oxidant b - mild oxidant c - mild reductant

(25) KI_2O_3 in 2-4 pH soln -

a - 6 electrons to I^- b - 5 electrons to I_2

from conc of Cl
a- directly ~~inversely~~ c- m

(27) benzoquinone is ~~in quinhydrone electrode~~
a- oxidized ~~reduced~~ c- complexed

(28) has pH range of

a- GE (2-12) ~~1-10~~ b- DA ~~1-10~~

(29) Composed of SiO_2 , CaO , Na_2O

a- WAS ~~little silica~~ side line

(30) Consist of 50 I_2 in an anhydrous solvent

a- ZRE ~~KF~~ c- GE

(31) known is a med in presence of H_2PO_4^- reduced to

a- Mn^{+2} b- MnO_4^- ~~Mn^{+3}~~

(32) known used to det polyhydric compounds in ~~acidic~~ medium

a- a b- a + F ~~basic~~

(33) standardization of KMnO₄ by

a- $(\text{COOH})_2$ ~~(C₂H₄O₄)~~ c- $\text{K}_2\text{Cr}_2\text{O}_7$

(34) if titration of Fe^{2+} by Ce^{4+} the Potential

after addition of a- it will be Ce^{4+}

so it will be Ce^{4+}

Analytical Method

Q1) M C Q

a) which of the following compounds is used as P.M indicator
 * DPA + 10 * either

b) which of the following can be titrated by EDTA P
 * Ag * Co * Na * neither

c) To titrant Ca^{2+} by EDTA. The pH of the medium
 should be adjusted by -

a) NH_3/NH_4Cl buffer ✓ b) HNO_3 c) neither

d) CH_3COOH/CH_3COOK

d) which of the following cations could be titrated
 by EDTA in medium having pH $\rightarrow 3$?

a) B^{3+} b) Hg c) Fe d) either or neither

e) KCN can mask the following cations:-

1) Zn 2) Ca 3) Na 4) $Zn + Cd$ ✓

f) which of the following compound can be used as
 primary standard redox titration

* $K_2Cr_2O_7$ * $CoCl_2$ * $KMnO_4$ * $A+B$

g) which of the following compounds can be used as
 redox indicator ?

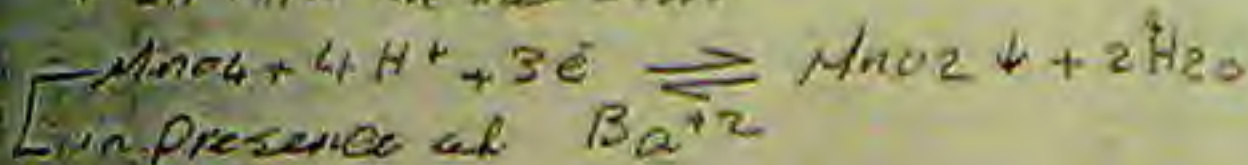
* Feric * Ferriin * DPA * $FeCl_3$ * $AgCl$

h) The equivalent weight of K_2MnO_4 (Mol wt) = 158 = $\frac{M}{5}$
 when used in acid medium and in presence of F^-
 equal to - 1) 52.88 2) 39.50 3) 39.50 4) neither

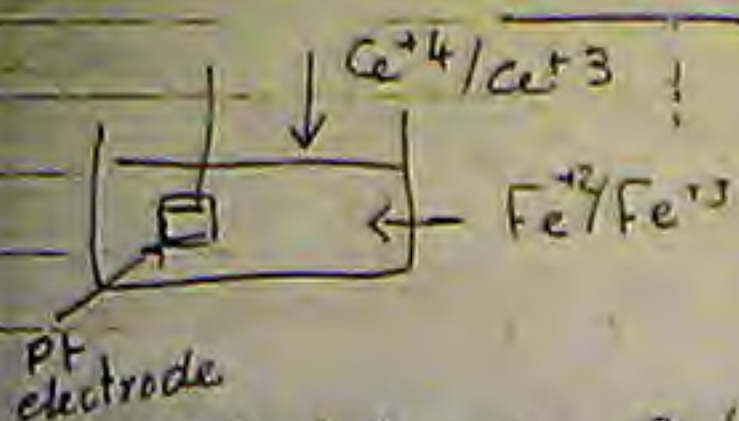
i) $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ acidified
 by acid \rightarrow in presence of F^-
 $MnO_4^- + 8H^+ + 4e^- \rightarrow Mn^{3+} + 4H_2O$

Molecular weight
 No. of electrons

* In HClO₄ medium

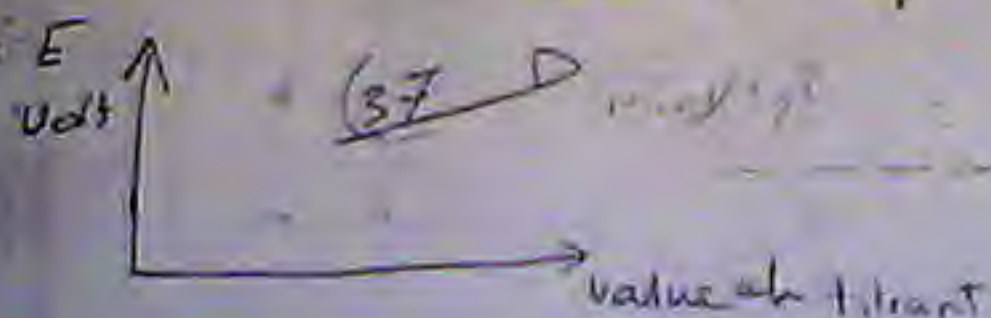


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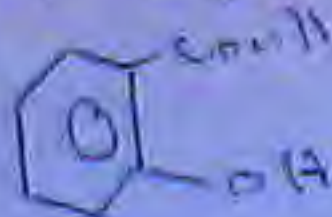
Calculate the E of the cell?

$$E = E_0 + \frac{0.059}{n} \times \log \frac{[\text{Ox}]}{[\text{Red}]}$$



Point	Formation	Value E
0	—	—
50%	$\frac{E_1 + E_2}{2}$	$\frac{E_1 + E_2}{2}$
100%	$\frac{E_1 + E_2}{2}$	$\frac{E_1 + E_2}{2}$
200%	$\frac{E_1 + E_2}{2}$	$\frac{E_1 + E_2}{2}$

Q3 → The bromination of SA



Q) The iodometric titration of Br_2

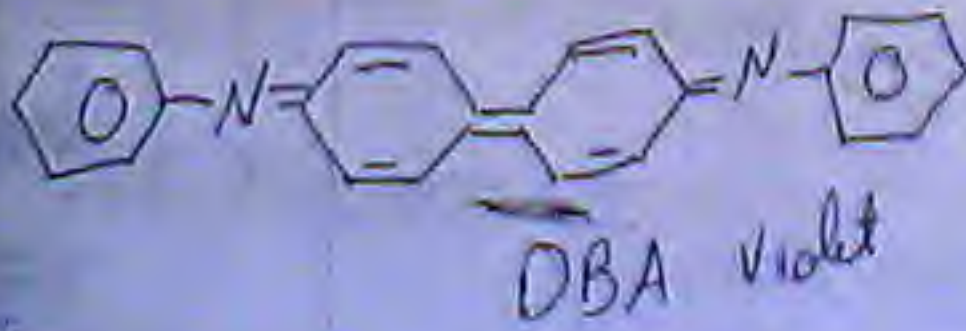
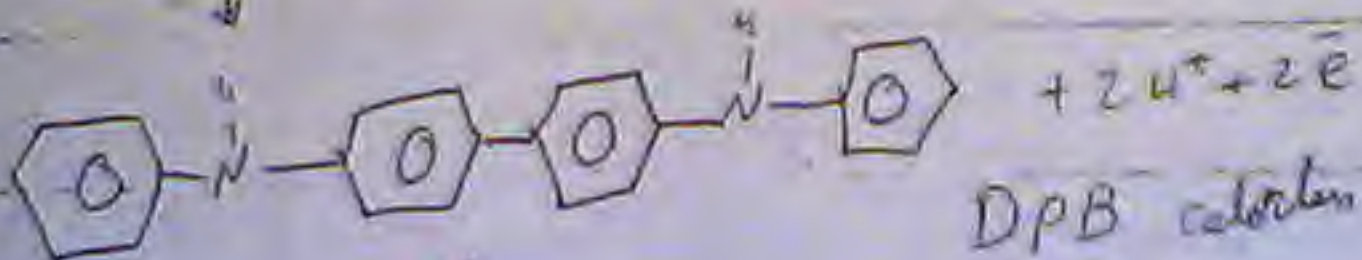
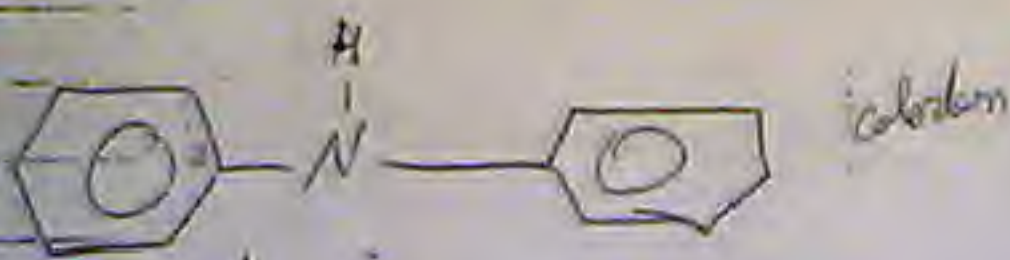
Solution $\text{Br}_2 + 2\text{I}^- \rightarrow \text{I}_2 + 2\text{Br}^-$



→ The Mechanism of DPA as Redox indicator

Solution ketohexizer reagent

CHI



ملاحظات

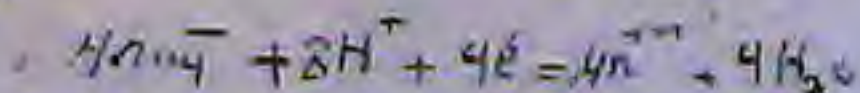
- Equivalence weight of KMnO_4 .

1) - In acid medium.



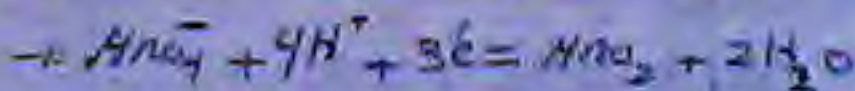
$$\begin{aligned}\text{Equivalence weight} &= \frac{\text{Molecular weight}}{\text{No. of electrons}} \\ &= \frac{4 \text{ weight}}{5}\end{aligned}$$

2) In presence of F^-



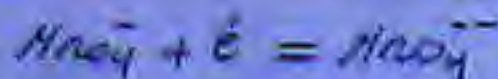
$$\text{Equivalence weight} = \frac{\text{M. weight}}{4}$$

3) In alkaline medium.



$$\text{Equivalence weight} = \frac{\text{M. weight}}{3}$$

4) In presence of Ba^{++} ions.



$$\text{Equivalence weight} = \frac{\text{M. weight}}{1}$$

Which cation can be determined by EDTA

- a) Ag^+ b) Ca^{++} c) As^+ d) either one e) neither one

ICN can not

- ~~a) Zn^{++}~~ a) Ca^{++} ~~b) Cd^{++}~~ d) As^+ Ver a, b, c

Primary standard red titration

- a) $\text{K}_2\text{Cr}_2\text{O}_7$ b) $(\text{CuOH})_2$ c) H_2SO_4 d) a, b, c e) d, e

What are used as red indicator

- a) Eriol (EBT) b) Ferron c) DPA d) b, c

So N.B.

Bi^{+++} & Hg^{++} & Fe^{+++} can be titrated by EDTA

$\text{pH} = (1-3)$

Match

Column A

- 1- $I_3^- / 2OH^-$
- 2- KIO_3
- 3- $Na_2S_2O_3$
- 4- SO_2
- 5- KI_3
- 6- KF
- 7- Vanamine blue B
- 8- PAN
- 9- PAR
- 10- ~~ANNN~~ ^{AES}
- 11- GLC
- 12- SCE

Column B

- ~~PAR~~ Pyridine azo resorcinol
- Consist of SO_2 & I_2 in non aq solvent
- ~~PAN~~ Pyridine azo naphthol
- ✓ Atomic emission spectroscopy
- standard Calomel electrode
- has blue color when oxidized
- ✓ Gas Liquid chromatography
- used to det $RCHO$
- titrant of Andrew's method
- titrant used in iodometry
- back titrant in iodometry
- Component of KF reagent

Curriculum reagent

- 9
- 6
- 8
- 10
- 12
- 7
- 11
- 1
- 2
- 5
- 3
- 4

1- EBT

- 2- EDA (ethylenediamine)
- 3- Trien
- 4- EDTA
- 5- DMG
- 6- Morgan, Dren
- 7- Porphyrin
- 8- $X-O$
- 9- NH_2
- 10- Argentometric
- 11- K_2CrO_4

- rigid chelating agent
- proposed term chelate
- has orange color in pH 7-11
- has yellow color in a medium
- tetradentate ligand
- ✓ has 2 OH groups & is organic
- tetra amino a
- Didentate ligand
- det of Cu^{2+} using $AgNO_3$
- used as Ind in Leiberge method
- neutral unidentate ligand

- 7
- 6
- 1
- 2
- 3
- 5
- 4
- 2
- 10
- 11
- 9

DMG plant preparation

→ MCQs:-

1- in KIO_3 as an oxidant use as Ind :-

a- $CHCl_3$ b- NO c- Nurexide d- NH_3 / NH_4Cl

2- $I_3^- / 2OH^-$ used for det. of :-

a- amine b- glucose c- NH_3 d- Phenol

3- the titrant in Andrew's method:-

a- KIO_3 b- I_2 c- IO_3^- d- $KMnO_4$

4- which of the following is thermal analysis:-

a- AAS b- GLC c- TGA d- AES e- none

5- which is antiseptic:-

a- phenol b- salicylic acid c- benzoic acid d- none

6- antifungal white field ointment:-

a- varamine blue B b- mix. of salicylic acid & benzoic acid
c- NH_3 / NH_4Cl d- Sulfonamides

7- the antimicrobial agent is

a- sulfonamide b- PAU c- PAR d- phenol

8- to titrate Ca^{2+} by EDTA the pH should be adjusted by

a- NH_3 / NH_4Cl b- HNO_3 c- CH_3COOH / CH_3COONa d- neither one

9- which of the following can be titrated by EDTA at pH 10:-

a- Ba^{2+} b- Hg^{2+} c- Fe^{3+} d- either e- neither

✓ 10 - which of the following can be used as 10^{19} standard in redox reaction.

✓ a - K_2CrO_7 b - $(CoCl)_2$ c - $KMnO_4$ d - a & b

✓ 11 - which is redox Ind.

a - Erio-t [EBT] b - Ferroin c - DPA d - b & c

✓ 12 - equivalent wt of $KMnO_4$ is a med + F is:-

a - 52.66 b - 39.5 c - 81.6 d - neither

→ Complete :-

1 - is specific no of ligands that are bonded to each metal ion

2 - unidentate ligand may be classified into:

a) anionic eg Cl^- , SCN^-
b) neutral eg H_2O

3 - multidentate ligand may be called chelating agent that form ring structure when bonded with metal

4 - triethylene tetramine is a tetradentate ligand can attach with metal ion at 4 sites of attachment

5 - chelating agent may be - (planar)

(a) rigid which is contain rings
can rotate

eg Porphyrins

eg EDTA

(b) flexible

6- $[Ag(NH_3)_2]^+$ Complex is linear in shape while $[Fe(CN)_6]^{3-}$ Complex is octahedral in shape.

7- Small size & large charge on the metal ion \uparrow the Complex stability ex Fe^{+3} more stable than Fe^{+2}

8- as the ligand size \uparrow , the Complex stability \downarrow increase eg I^- Complex more stable than Br^- Complex

9- As the no of rings per ligand \uparrow , the stability of the metal chelate \uparrow increase

10- Cd^{+2} Can be titrated with EDTA using EBT while Al^{+3} Can't due to form more stable Complex with EBT more than EDTA-Al Complex



Q. II Mark (✓) for the Correct statement and (X) for The false one:-

- 1- For Ca-ISE, the potential plot against Ca^{2+} activity has slope equals 0.059 Volt. (X)
- 2- for 1st Kind electrode; the plot of electrode potential against PM give inversely linear relation (✓)
- 3- for 2nd Kind electrode; the plot of electrode potential against Concentration of Cl^- is directly proportional linear relation. (X)
- 4- In Nernst equation $2.3RT/F$ equal to 0.059 when Temp equals 293 K. (X)
- 5- $\text{Fe(s)} / \text{Fe}^{++}$ is an electrode of 1st Kind (X)
- 6- The pH-GE is an electron transfer electrode (X)
- 7- $\text{Sb}_2\text{O}_3(\text{s}) / 2 \text{ Sb(s)}$ electrode is pH responsive electrode (✓)
- 8- the pH range of Quinhydrone electrode is 0-8.0 (✓)
- 9- Lithia Silica glass electrode is used to determine Li^+ (X)
- 10- the pH range of GE is 0-13 (✓)
- 11- GE interferences with dehydrating agent, salt of F ions and surface active agents (✓)
- 12- HE is pH responsive unlimited (✓)
- 13- Antimony electrode interferences with oxidizing agents, Cu ions and anions of hydroxy acids (✓)
- 14- Quinhydrone electrode interferences with protein and amines (✓)
- 15- HE interferences with oxidizing agents and reducible organic substances (✓)
- 16- GE has high resistance as disadvantages (✓)

17. Antimony electrode is not completely reversible as disadvantages (✓)
18. Hydroquinone electrode is limited in pH range and easily destructive (✓)
19. H₂E electrode and Antimony electrode is electron transfer electrode while G.E is an ion exchange electrode (✓)
20. The potential of CE depend on [C⁺] and temperature (✓)
21. Ag|AgBr electrode can be used to determine [Br⁻] (✓)
22. The boundary potential of Ag|AgCl electrode depends on [Cl⁻] X
23. CO₂ sensing probe is a complete ECC ✓
24. The responsive membrane of F-ISE is a single crystal of NaF X
25. In measuring pH by F-ISE the soln. should be acidic ✓
26. EDTA is an aminopolycarboxylate ligand ✓
27. H₂N-CH₂-(CH₂)₄-CH₂-NH₂ is a bidentate ligand X
28. (CH₂NH₂)₂ is a quadridentate ligand ✓
29. As the radius of ligand is larger, the stability of complex increases ex $I^- > Br^- > Cl^-$. ✓
30. As the radius of metal is larger, the complex stability increase X
31. By increase the donating power of ligand the stability increase ex $N > O > Cl^- > Br^- > I^-$. X
32. Phenanthroline is a tridentate ligand and rigid ✓
33. Orme is a hydroxy bidentate ligand ✓
34. amino acid may be considered with metal as ✓

35. all metal can have more than one coordinate no. ✓
36. Titration with EDTA is Chelometric titration. ✓
37. All metal Complexes are stable in basic medium. X
38. Disodium salt of EDTA is soluble in H_2O . ✓
39. pH value has no effect on the complexes formation. X
40. Nitric acid is a suitable medium for B^{3+} . ✓
41. In Andrews's method, starch soln is used to indicate the end point. X
42. MnO_4^- able to determine H_2O_2 . ✓
43. Iodimetry use iodine directly as oxidant while iodometry iodine liberated from the reaction. ✓
44. Arsenate can be titrated iodometrically. X
45. For $AsO_3^{3-} + I_2 + H_2O \rightleftharpoons AsO_4^{3-} + 2I^- + 2H^+$ by increasing pH value find the reaction go to the formation of products. ✓
46. Use starch as indicator in Iodimetric titration and add it after end point. X
47. Hypoiodite (I_2/OH^-) can be used in the determination of aldehydes and glucose. ✓
48. Andrews's reaction use strong acid medium and an chlorated solvent with potassium iodate reaction. ✓
49. Iodine standard is prepared by dissolving it in KI why? ✓
50. Can determine Cr^{3+} by Iodometry. ✓
51. Easily can use starch as indicator in case of with I^-/I_2 system. why? X

52. CuSCN is a white insoluble ppt

53. Starch indicator For Iodimetry and Iodometry is added at the start of titration

54. The Librated Iodine equivalent to reductant (oxidant) That in solution.

55. Iodometry Can determine oxidants as $\text{Cr}_2\text{O}_7^{2-}$

56. Iodometry Can determine Cu^{2+} in the presence of SCN^-

57. Hypoiodite is very mild oxidizing agent it oxidize alcohols and aldehydes

58. The excess remaining of I^- can be determined by acidification by H_2SO_4 to give I_2 as the equation

59. Potassium iodate is a strong reductant in acidic medium (4M HCl)

60. In KIO_3 titration Can not use starch as indicator. due to

61. KIO_3 Can be used in the determination of I^- , hydrazine and hydrazine derivatives

62. KIO_3 able to oxidize I_2 into I^+ . The color of I_2 is yellow

63. Most iodine titration must be carried in iodine flask with stopper. Because I_2 is volatile

64. To decrease the conc of acid from 4M HCl to 1-2M can use KCN Because form I^- complex which is more stable than I_2

65. H_3BO_3 Can be used as preservative for starch to prevent or decrease the Micro-decomposition.
66. Can use SCN^- as a specific indicator for Fe^{3+}
67. Salicylic acid is colorless but when bonded with Fe^{3+} give ~~violet~~ while Vanamine blue B when oxidize will give ~~blue~~

68. Conc ammonium nitrate is 1g standard substance and can use as self indicator

69. Also, use Ferrin/Ferrou system as a redox indicator in case of Ce^{4+} titration

70. Can use Ce^{4+} in any medium in the titration.

- This is due to the titration carried only in acidic medium which prevent the precipitation of $CeO_2 \cdot xH_2O$

71. Can use with $KMnO_4$, EBT as indicator.

- due to EBT is a pH indicator and $KMnO_4$ is self indicator

72. BAL can be used as indicator for Pb^{2+}

- BAL is a Masking for Pb^{2+}

73. TEA used as a masking agent for Al^{3+}

74. Bi^{3+} and Mg^{2+} mixture can be analysis

by changing the buffer system

75. Bi^{3+} and Fe^{3+} mixture can be analyse by

changing the pH of the medium and masking process.

- Can analyze by adjustment the oxidation state of Fe^{3+} as $Fe^{3+} \xrightarrow[\text{acid}]{\text{ascorbic}} Fe^{2+}$

76. Oxalate anion can be used as a precipitating agent for Mg^{2+} .

- Oxalate can be used for Ca^{2+}

77. Acetate or hexamine can be used with the titration of Cu^{2+} , Pb^{2+} and Bi^{3+} ✓

- and by changing the pH again, can analyse the others

78. I_2 is a volatile while Br_2 is not. (X)

79. Easily to prepare a standard solution (X)

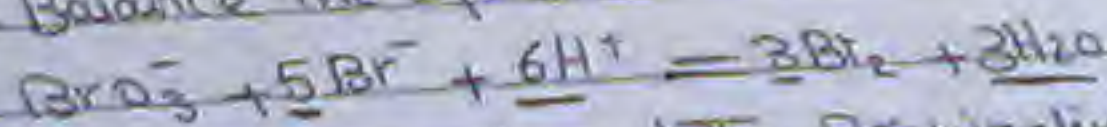
~~80~~ Bromine is an unstable solution and an aqueous solution

81. Bromine is prepared in situ from $KBrO_3/5Br^-$ salt

82. Quantitative bromination able to determine aromatic ring activating by ✓

83. Br_2 is produced by making the solution alkaline (X)

84. Balance the equation



85. Put the sample and the brominating agent in an iodine flask then acidify by HCl then put them in sunlight (X)

86. Br_2 can be detected by iodometric technique ✓

87. Phenol is antiseptic. a complete ✓

88. To avoid the volatilization of phenol added NaOH to give the stable form which is sodium phenoxide

89. Phenol when brominated gives tribromophenol

91. Antifungal ointment contain benzoic acid and Salicylic acid.

92. Sulfonamides may be consider Weak acid.

93. Thymol blue used as indicator in case of Sulfonamide with brominating agent in Dimethyl Formamide solvent.

94. Oxine can be use as a bidentate ligand and use in the determination of Mg²⁺ by forming Mg oxinate complex.

95. EDTA can determine non metal like S and P (✓)

96. How can determine Mg²⁺ by using Oxine??

97. Oxine may be 6 or 7-hydroxy Quinoline. (X)

98. emf can be experimentally measured. (✓)

99. The electrode potential can be measured

→ experimentally but can be measured by Nernst equation (X)
which states $E = E^0 - \frac{RT}{nF} \ln Q$

X 100. NHE act as reference electrode.

101. The potential of Calomel electrode depend on The AgCl conc Because (X)

102. SCE affected By Temp. (X)

This is due to

103. The potential of The 1st Kind electrode depend on The conc of The metal. while it proportional to The conc of it's metal ion (X)

104. Tungsten act as indicator electrode (X)

- This is due to strain or deformation of crystal structure

(Inversely / directly) proportional to The conc of Cl^-

106. Inert electrode responsible for ensure electrical contact.

107. By changing The inert electrode The potential of ion/ion system will alterd

108. HE is limited but use it as SHE as a reference electrode

109. HE is a dry kind electrode.

• It is a dry kind

110. P-benzohydroquinone Can be (reduced or oxidized) in hydroquinone electrode

111. Cds with Ag_2S is a crystalline electrode which sensitive to Cd^{2+} .

112. Valinomycin Can be detect The K^+ ion it by Ca-ISE.

• By K-ISE

[Q10]

• P. 31. to det E^0 (standard electrode potential) we use SHE

• P. 50. In KF reagent Pyridine used to dissolve $LiCl$ sol, used also as base \rightarrow \uparrow rate of reaction

• P. 52. $HCHO$ (anthracene sol)

• P. 51. Lugol's sol (used in hypothyroidism)

\rightarrow in large's med we can use starch as ind. (blue color)

• P. 60. bromometry - BHT by vanilene \rightarrow can be det - but, BHT \rightarrow can't be det.

\rightarrow S. can be det using OH^- (hypochlorite)